Phase 5: Regulatory Action Selection

Final Project Report

Total Maximum Daily Loads for Pathogens in Aptos and Valencia Creeks, Including Trout Gulch Santa Cruz County, California

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CONTENTS

Table of Tables

Table of Figures

Appendices

List of Acronyms and Abbreviations

This document contains numerous acronyms and abbreviations. In general, an abbreviation will be given in parentheses ( ) following the first time a title or term is used, and the abbreviation will be used in almost all cases in place of that term later. Staff included abbreviations used in this document in the following alphabetical list to assist the reader:

CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
County	The County of Santa Cruz
CSMP	Collection System Management Plan
CWA	Clean Water Act
CWC	California Water Code
USEPA	United States Environmental Protection Agency
E. coli	Escherichia coli bacteria
MF	Membrane Filter
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NMFs	National Marine Fisheries
REC-1	Water Contact Recreation
REC-2	Non-Contact Water Recreation
Sanitation District	Santa Cruz County Sanitation District
SWMP	Storm Water Management Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
Water Board	Central Coast Water Board
WDR	Waste Discharge Requirements
WQO	Water Quality Objective
WWTP	Waste Water Treatment Plant

1. PROJECT DEFINITION

1.1. Introduction

The Aptos Creek Watershed is located in southern Santa Cruz County and encompasses approximately 24.5 square miles. Aptos Creek's main tributaries are Valencia Creek, Mangels Gulch, and Bridge Creek. Trout Gulch is a tributary to Valencia Creek. The Creek drains to the Aptos Creek Lagoon and ultimately to Monterey Bay, south of Santa Cruz, California. The project area includes Aptos Creek and all tributaries. Aptos Creek Lagoon is not included in the project area.

The Clean Water Act Section 303(d) requires the State to establish a Total Maximum Daily Loads (TMDLs) for Aptos and Valencia Creeks. TMDLs are required because these waters have been identified as impaired for pathogens and have been placed on the 303(d) List. The State must also incorporate seasonal variations and a margin of safety into the TMDLs that include any lack of knowledge concerning the relationship between load limits and water quality.

This report also proposes a TMDL for an unlisted waterbody, Trout Gulch. Staff proposes a TMDL and water quality improvement measures in the Implementation Plan section because this water body is not attaining bacteria water quality objectives and flows into Valencia and Aptos Creek, respectively.

Aptos Creek

Aptos Creek is on the 303(d) list for non-attainment of bacteria water quality objectives. Based on historic and recent data, pathogen indicator organism (fecal coliform bacteria) concentrations exceed *Water Quality Control Plan, Central Coast Region* (Basin Plan) water contact recreational use objectives during both wet and dry seasons. There does not appear to be any impairment on Aptos Creek (nor on its tributaries, Bridge Creek and Mangels Gulch) above the confluence with Valencia Creek. Staff concluded the causes of impairment were birds, rodents, and wildlife, farm animals/livestock, sewage connection failures, and storm drain discharges. Staff proposed allocations for all sources and implementation actions for controllable sources.

Valencia Creek

Valencia Creek is on the 303(d) list for non-attainment of bacteria water quality objectives. Based on historic and recent data, pathogen indicator organism (fecal coliform bacteria) concentrations exceed Basin Plan water contact recreational use objectives during both wet and dry seasons. The causes of impairment were birds, rodents, and wildlife, farm animals/livestock, sewage connection failures, and storm drain

discharges. Staff proposed allocations for all sources and implementation actions for controllable sources.

Trout Gulch

Trout Gulch is not on the 303(d) list, however, it does not attain bacterial water quality objectives. Based on historic and recent data, the pathogen indicator organism (fecal coliform) concentrations exceed Basin Plan water contact recreational use objectives during both wet and dry seasons. The causes of impairment were birds, rodents, and wildlife, farm animals/livestock, sewage connection failures, and storm drain discharges. Staff proposed allocations for all sources and implementation actions for controllable sources.

1.2. Listing Basis

According to the United States Environmental Protection Agency (USEPA) Protocol for Developing Pathogen TMDLs (USEPA Protocol), "the numbers of pathogenic organisms present in polluted waters generally are few and difficult to isolate and identify, as well as highly varied in their characteristic and type. Therefore, scientists and public health officials typically choose to monitor nonpathogenic bacteria that are usually associated with pathogens transmitted by fecal contamination but are more easily sampled and measured. These associated bacteria are called indicator organisms. Indicator organisms are assumed to indicate the potential presence of human pathogenic organisms. When large fecal coliform populations are present in the water, it is assumed that there is a greater likelihood that pathogens are present." The Basin Plan includes fecal coliform concentrations as water quality objectives to represent pathogenic organisms.

Aptos Creek

The California Regional Water Quality Control Board, Central Coast Region (Water Board) placed Aptos Creek on the 303(d) list of impaired waters for pathogens in 1994. Aptos Creek exceeded water contact recreation water quality objectives for fecal coliform. County of Santa Cruz, Environmental Health Department (County) provided the data to support the listing. The County's recent data is discussed in Chapter Three.

Valencia Creek

The Water Board placed Valencia Creek on the 303(d) list of impaired waters for pathogens in 1994. Valencia Creek exceeded water contact recreation water quality objectives for fecal coliform. The County provided the data to support the listing. The County's recent data is discussed in Chapter Three.

1.3. Beneficial Uses

The Basin Plan contains beneficial uses for Aptos Creek, Valencia Creek, and Trout Gulch. The beneficial uses are shown in Table 1.

Table 1. Beneficial Uses for Aptos Creek[1], Valencia Creek, and Trout Gulch

Beneficial Use	Waterbody Name		
	Aptos Creek	Valencia Creek	Trout Gulch
Municipal and Domestic Supply (MUN)	X	X	X
Agricultural Supply (AGR)	X		
Industrial (IND)	X		
Groundwater Recharge (GWR)	X	X	X
Water Contact Recreation (REC-1)	X	X	X
Non-Contact Water Recreation (REC-2)	X	X	X
Wildlife Habitat (WILD)	X	X	X
Cold Fresh Water Habitat (COLD)	X	X	X
Migration of Aquatic organisms (MIGR)	X	X	
Spawning, Reproduction, and/or Early Development (SPWN)	X	X	
Preservation of Biological Habitats of Special Significance (BIOL)	X		
Rare, Threatened, or Endangered Species (RARE)			
Estuarine Habitat (EST)	X		
Freshwater Replenishment (FRSH)	X		
Commercial and Sport Fishing (COMM)	X	X	X

[1] – Bridge Creek is a small upper tributary to Aptos Creek and has beneficial uses identified in the Basin Plan. However, we are not considering Aptos Creek above the confluence with Valencia Creek to be impaired (see section 3). Therefore, we are not proposing any load allocations for Bridge Creek and are not identifying its beneficial uses here in this table.

1.4. Water Quality Objectives

The Basin Plan states, "*Controllable* (emphasis added) water quality shall conform to the water quality objectives contained herein. When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality."

The Basin Plan contains specific water quality objectives that apply to fecal coliform (Basin Plan, pg. III-10). These objectives are linked to specific beneficial uses and include:

Water Contact Recreation (REC-1)

Fecal coliform concentration, based on a minimum of not less that five samples for any 30-day period, shall not exceed a log mean of 200 per 100 mL, nor shall more than 10% of samples collected during any 30-day period exceed 400 per 100 mL.[1]

E. coli is another pathogen indicator organism. The Basin Plan does not currently include water quality objectives for *E. coli*. However, USEPA recommends *E. coli* not exceed a log mean of 126 CFU per 100 mL, based on not less that 5 samples equally spaced over a 30-day period. The USEPA also recommends that not more than 10% of samples collected during a 30-day period exceed 235 per 100 mL. (USEPA, *Ambient Water Quality Criteria for Bacteria-1986*, January 1986*)*.

Non-Contact Water Recreation (REC-2):

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 2000 per 100 mL, nor shall more than10% of samples collected during any 30-day period exceed 4000 per 100 mL.

Other Beneficial Uses

The Basin Plan does not include explicit numeric objectives for the other surface water beneficial uses.

1.5. Waste Discharge Prohibition

The *Water Quality Control Plan, Central Coast Region* (Basin Plan) contains the following discharge prohibition (Chapter Five, Section IV.B).

> "Waste discharges to the following inland waters are prohibited: All surface waters within the San Lorenzo River, Aptos-Soquel, and San Antonio Creek Subbasins and all water contact recreation areas except where benefits can be realized from direct discharge of reclaimed water."

Aptos and Valencia Creeks are both within the Aptos-Soquel subbasins, and as such, no waste discharges are allowed to these waterbodies.

[1] Throughout this document, fecal coliform units are expressed as colony forming units (CFU) (#/100mL or CFU/100 mL) and most probable number (MPN). All unit expressions are considered equivalent fecal coliform bacteria concentration measures (Reference: Protocol for Developing Pathogen TMDLs).

2. WATERSHED DESCRIPTION

2.1. Location, Climate, and Hydrology

The following describes the Aptos Creek Watershed's location, climate and hydrology (Swanson 2003):

> [The Aptos Creek Watershed is located in Santa Cruz County, California.] There are two main subwatersheds that make up the Aptos Creek Watershed: Aptos Creek and Valencia Creek. These two subwatersheds are similar in size; Aptos Creek totals 11.2 mi^2 and Valencia Creek totals 9.41 mi^2. Their confluence occurs approximately 0.5 miles upstream of the coastal lagoon. Several other smaller subwatersheds occur within each of these primary subwatersheds, including Bridge and Mangels Gulch in the Aptos Creek subwatershed, and Trout Gulch in the Valencia Creek subwatershed.
>
> The Aptos Creek Watershed is located in the temperate climate of the Central California coast, characterized by cool wet winters and dry warm summers. The dry season typically lasts from May to October with stream flow declining through this period. The lowest flows of the season typically occur in August and September until the winter rains return in December. Summer days near the coast can stay fairly cool due to the influence of the coastal marine layer. When winter rains hit the coastline, the amount of precipitation is enhanced by steep terrain, producing orographic uplift and heavy rains, especially in the upper watershed. Average annual rainfall totals range from over 50 in/yr in the headwaters to 22 in/yr at the mouth.
>
> The hydrology of the Aptos and Valencia Creek watersheds is typical of the conditions found in most small coastal streams of Santa Cruz County. Winter peak flow events can be characterized as flashy and are tied closely to the duration and magnitude of winter rainfall and antecedent soil moisture conditions. At the onset of the rainy season in late fall, much of the rainfall acts to saturate the soil and fill depression storage on the landscape, with little direct runoff to the stream channels Once the soil is saturated, additional rainfall directly contributes to runoff and other sources of flow, such as springs and seeps, become active. In an average winter, soil conditions will be saturated through April. Consequently, these months tend to have the highest runoff.

The Swanson report (2003) details the average monthly stream flow for Aptos Creek. Based on data collected from two United States Geological Survey gage stations between 1973 and 1985, average monthly stream flow ranges from about 29 cubic feet per second (cfs) in February (winter) to about 2 or 3 cfs in September (summer).

Aptos and Valencia Creek Watershed

Figure 1 below shows the location of the Aptos Watershed.

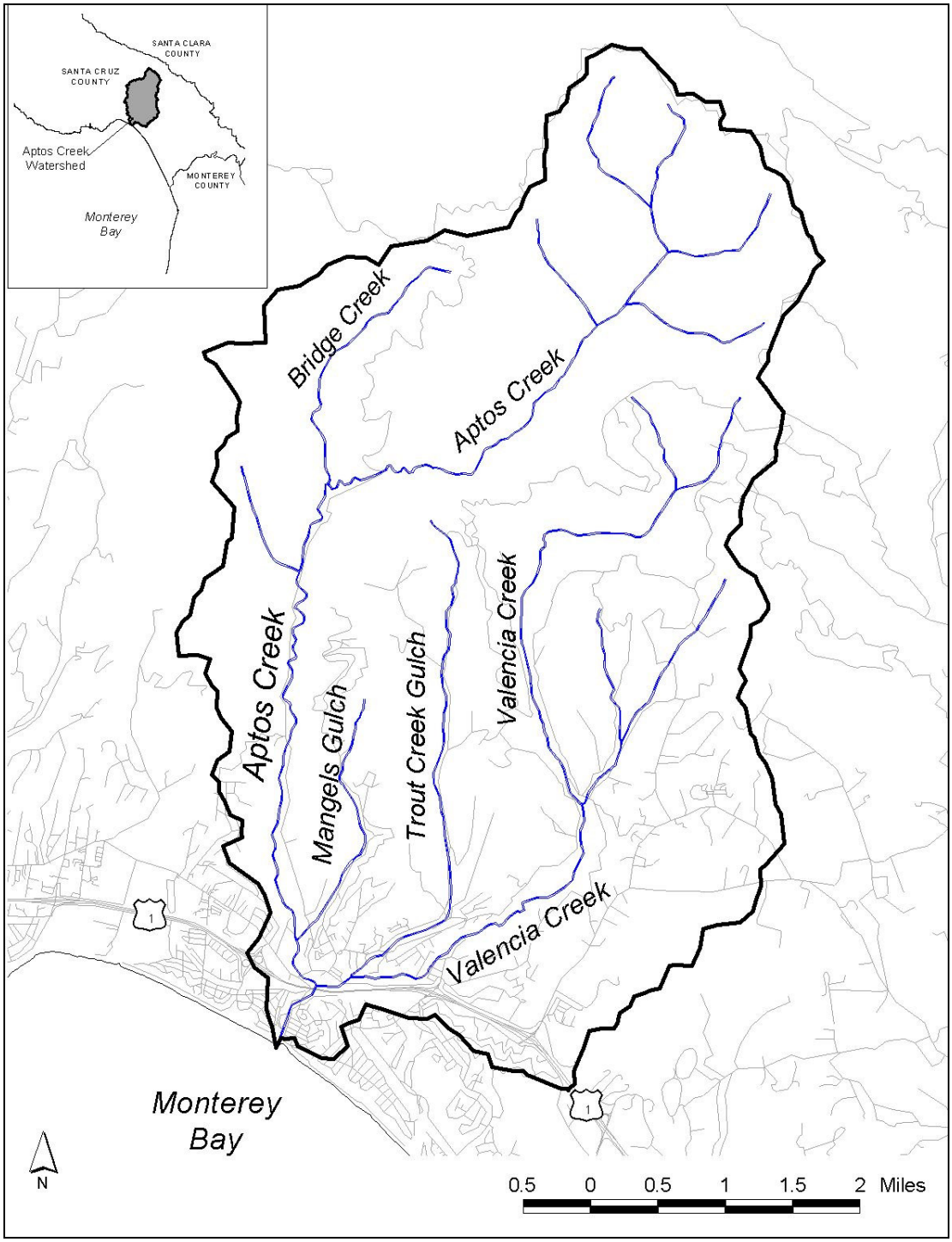

Figure 1. Location of the Aptos Watershed.

2.2. Land Use

Swanson Hydrology's report also gave a good description of land use in the Watershed (2003):

> Historically, both the Aptos and Valencia Creek Watersheds were heavily forested…and extensively logged through the 1920's. Recent land use conditions in these two watersheds have diverged considerably Table 2. Much of the Aptos Creek subwatershed is protected in the Forest of Nisene Marks, part of the California State Parks system, with the exception of Mangels Gulch and the lower portion of the Aptos Watershed where urban and rural residential land uses dominate. The Valencia Creek subwatershed, including Trout Gulch, is predominately privately owned with much of the lower watershed dominated by urban and rural residential land uses. Rural residential development is increasing in the upper watershed, though much of the land consists of large parcels dominated by orchards and selective logging.

Table 2: Characteristics of the Main Tributaries of the Aptos Creek Watershed, *taken from Swanson Hydrology (2003).*

Subwatershed	Sub-Shed Area (mi^2)	Main Tributary Length (mi)	Elev. Peak of Sub-Shed (ft)	Area and (%) of Impervious Surfaces[1]	Predominant Land Uses
Aptos/Bridge Creek	11.2	7.2	2624	0.23 mi^2 (2.1%)	Predominantly dense forested in upper watershed with a few residential parcels and open spaces in lower watershed.
Mangels Gulch	0.85	2.0	860	0.04 mi^2 (4.7%)	Predominately rural residential.
Trout Gulch	2.33	4.0	979	0.12 mi^2 (5.2%)	Rural residential, forested lands, and orchards.
Valencia Creek	9.41	7.3	1928	0.72 mi^2 (7.7%)	Dense residential in lower watershed with rural residential, forested lands, and orchards in upper watershed.
Total	24.2	20.5	2624	1.1 mi^2 (4.5%)	Urbanized in lower portions with channel highly modified through lagoon reach.

[1] – Percent impervious was estimated using a set of Santa Cruz County GIS layers depicting roads and parcels. Total road length was summed for each subwatershed area and multiplied by 30, assumed to be an average road width, to generate a total road area. The parcel layer was used to determine the total number of parcels in each subwatershed. Each parcel was assumed to have an impervious surface area of 2,000 sq ft including driveways, runoff areas, etc. Both values were converted to square miles and summed to provide an estimate of the total impervious surface area for each subwatershed.

Figure 2 shows land uses in the Aptos Watershed. Staff obtained Geographic Information System (GIS) land use data from the Multi-Resolution Land Characterization (MRLC)/National Land Cover Data (NLCD) database and subsequently grouped the data into land use categories (low intensity residential, urban, pasture, irrigated agriculture). The MRLC/NLCD data was created by various governmental agencies using satellite imagery. Staff used this data that represents land uses from 1988 to 1994. Staff presents these land uses because fecal coliform concentrations can be associated with them.

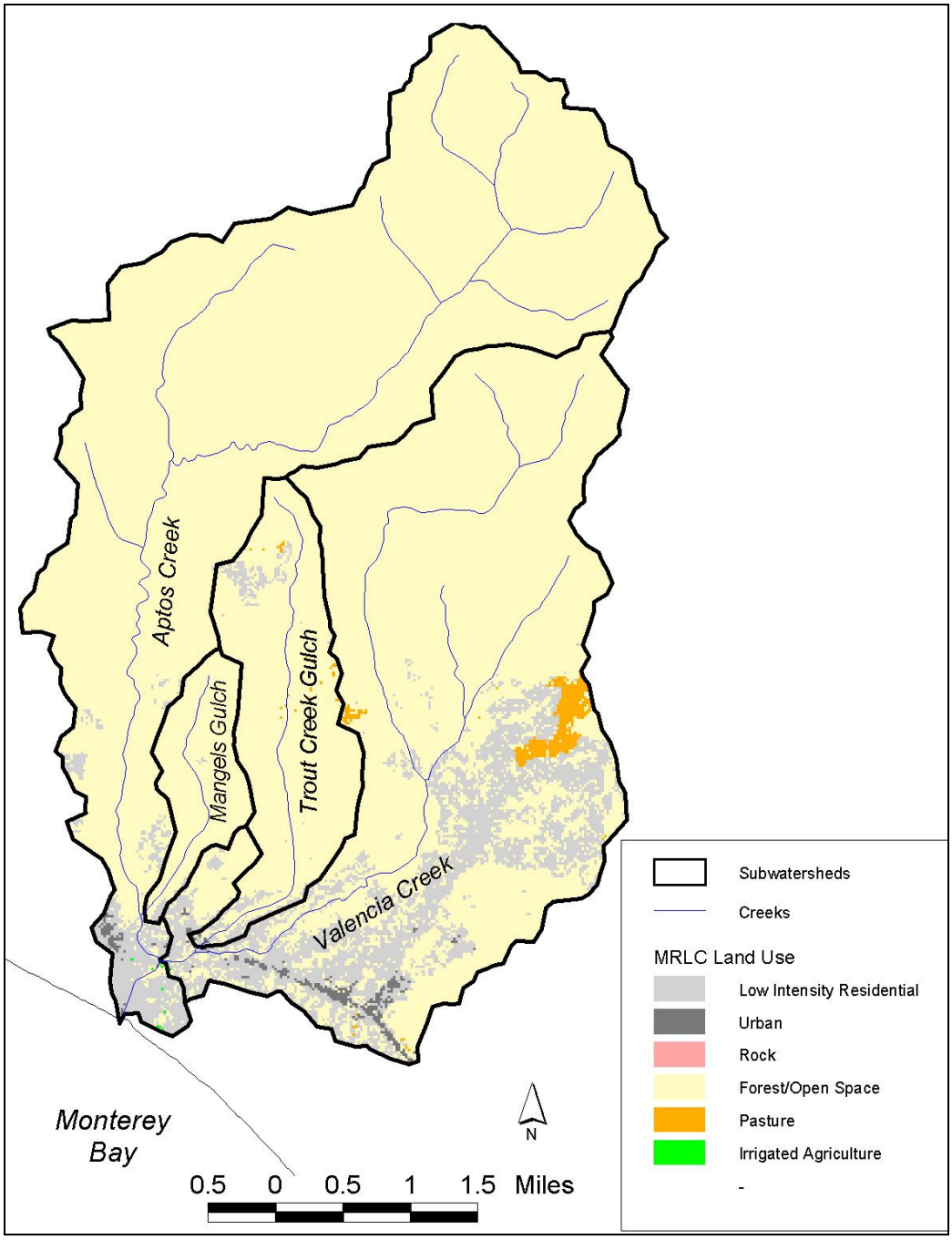

Figure 2. Aptos Watershed Land Uses

Figure 3 below shows percent land use acreage for the Aptos Watershed.

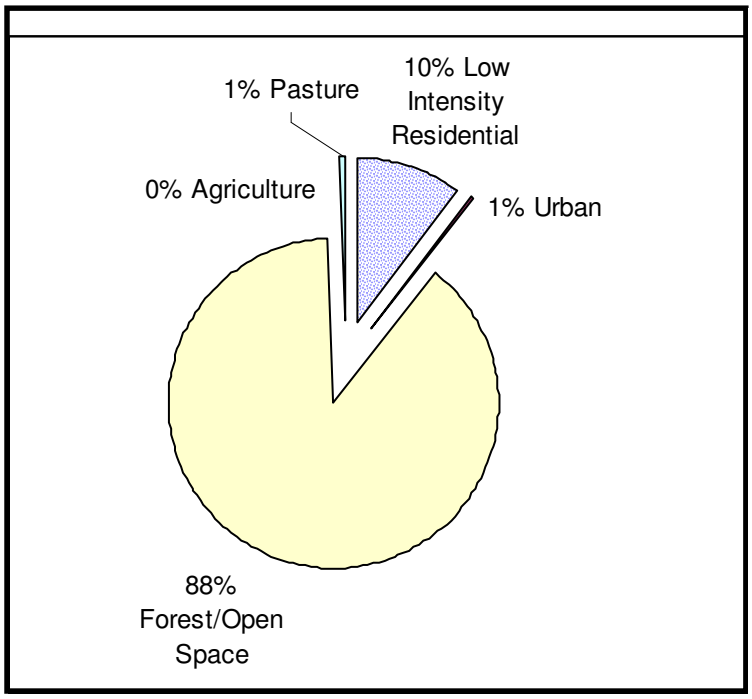

Figure 3. Percent Land Use in the Aptos Watershed.

The vast majority of the Watershed consisted of forest or open space (88%), as shown in Figure 2 and Figure 3. The next highest category was low intensity residential with only 10% of the total area. Both the pasture lands and urban lands comprise only 1% of the watershed area each.

3. DATA ANALYSIS

3.1. Water Quality Data

This section presents the water quality data staff used to develop the Total Maximum Daily Load (TMDL). Staff relied on the County of Santa Cruz Environmental Health Services (County) water quality sampling data. Recent (since 2003) fecal coliform sampling activities for the Aptos/Valencia Watershed are shown in Table 3 below. The County collected water quality data for several stations since the mid 1970's. This "historic" data showed approximately the same trends as the recent data, with the exception of station A2, which showed improvements in recent years.

Table 3. Santa Cruz County Environmental Health Services Fecal Coliform Sampling Activity Since January 1, 2003 (sampled from the mouth of Aptos, upstream to Valencia Creek)

Waterbody	Station #	Station	Number of Samples	Frequency	Period of Record
Aptos					
	A0	Aptos @ Creek Mouth	175	Weekly	1/16/2003 - 1/30/2006
	A03	Aptos C @ Bridge on Spreckles	19	Less than monthly	1/21/2004 - 9/13/2005
	A2	Aptos C @ Valencia Creek	39	Approximately monthly	1/13/2003 - 1/10/2006
Valencia Creek					
	A1	Valencia C @ Aptos C	56	Approximately monthly	1/13/2003 - 1/10/2006
	A12	Valencia Creek @ Trout Gulch	15	Sporadic	6/19/2003 - 9/13/2005
	A121	Valencia Creek Below School	3	Sporadic	11/20/2003 - 1/25/2005
	A1213	Valencia Creek @ Fork	9	Sporadic	1/25/2005 - 9/13/2005
	A12125	West Branch Valencia Creek	8	Sporadic	2/3/2005 - 9/13/2005
Trout Gulch					
	A11	Trout Gulch @ Valencia Creek	17	Sporadic	6/19/2003 – 9/13/2005
	A113	Trout Gulch @ Valencia Road	11	Sporadic	11/19/2003 – 9/13/2005
	A118	Trout Gulch @ End of Baker Road	9	Sporadic	1/25/2005 - 9/13/2005

As shown in the table, some sites had a more robust data set, while others have less data points. Site locations and results of the data are presented in section 3.3, Data Analysis Summary.

3.2. Flow Data

Measured flow data was not available for staff to include in this report. However, the County estimated summer flows for the Aptos Creek Watershed in their "Assessment of Sources of Bacterial Contamination At Santa Cruz County Beaches" (2006). Table 4 shows the *average* summer flow based on the County's estimations. Staff assumed winter flows to be much higher. These average summer flows were comparable to Swanson Hydrology's 2003 report cited in Section 2. These rough estimates show the relative contribution of flow from Aptos and Valencia. As Table 4 shows, the majority of the flow in the Watershed comes from Aptos Creek. Valencia Creek contributes about 20% of the flow to Aptos Creek.

Table 4: Estimated Summer Flows in the Aptos Creek Watershed (Santa Cruz County, 2006)

Location	Flow (cfs)
Aptos Creek [upstream of confluence with Valencia Creek]	2.5
Valencia Creek	0.5
Aptos At Spreckles [downstream of confluence with Valencia Creek]	3.0
Non-Specific Sources	0.1
Aptos @ Mouth	3.1

3.3. Data Analysis Summary

This section summarizes data contained in Appendix One. Table 5 shows the percent violation of the single sample maximum (400 MPN/100 mL) water quality objective for each station. There were not enough data to calculate the geometric mean for any of the stations except for the Aptos Mouth (AO) station.

Table 5. Aptos Watershed Percent Violations of Water Quality Criteria

Station	Station Number	Maximum Water Quality Objective	
		% Violations	Number of Samples
Aptos @ Creek Mouth	A0	61%	175
Aptos C @ Bridge on Spreckles	A03	32%	19
Aptos C @ Valencia Creek	A2	0%	39
Valencia C @ Aptos C	A1	64%	56
Valencia Creek @ Trout Gulch	A12	53%	15
Valencia Creek Below School	A121	67%	3
Valencia Creek @ Fork	A1213	0%	9
West Branch Valencia Creek	A12125	0%	8
Trout Gulch @ Valencia Creek	A11	82%	17
Trout Gulch @ Valencia Road	A113	64%	11
Trout Gulch @ Robideaux/Baker Road	A118	22%	9

Staff analyzed the percent exceedance of the bacteria water quality objective spatially (Figure 4) to determine where the water quality objectives were exceeded. Figure 4 shows that Aptos Creek violated water quality objectives from the mouth to the confluence with Valencia Creek. Above Valencia Creek, water quality objectives were not violated in Aptos Creek (including Bridge Creek and Mangels Gulch). Bacteria concentrations on Trout Gulch were higher than water quality objectives, downstream of sampling site A118 (Trout Gulch @ Robideaux/Baker Road). Valencia Creek exceeded water quality objectives from the confluence with Aptos Creek to downstream of where the Creek forks. There were no violations upstream of the fork.

Staff also analyzed additional sample results collected by the Coastal Watershed Council. The data and data analysis results are shown in Appendix One. The percent exceedance follows a similar exceedance pattern as the Santa Cruz County Environmental Health Department results shown in Table 5.

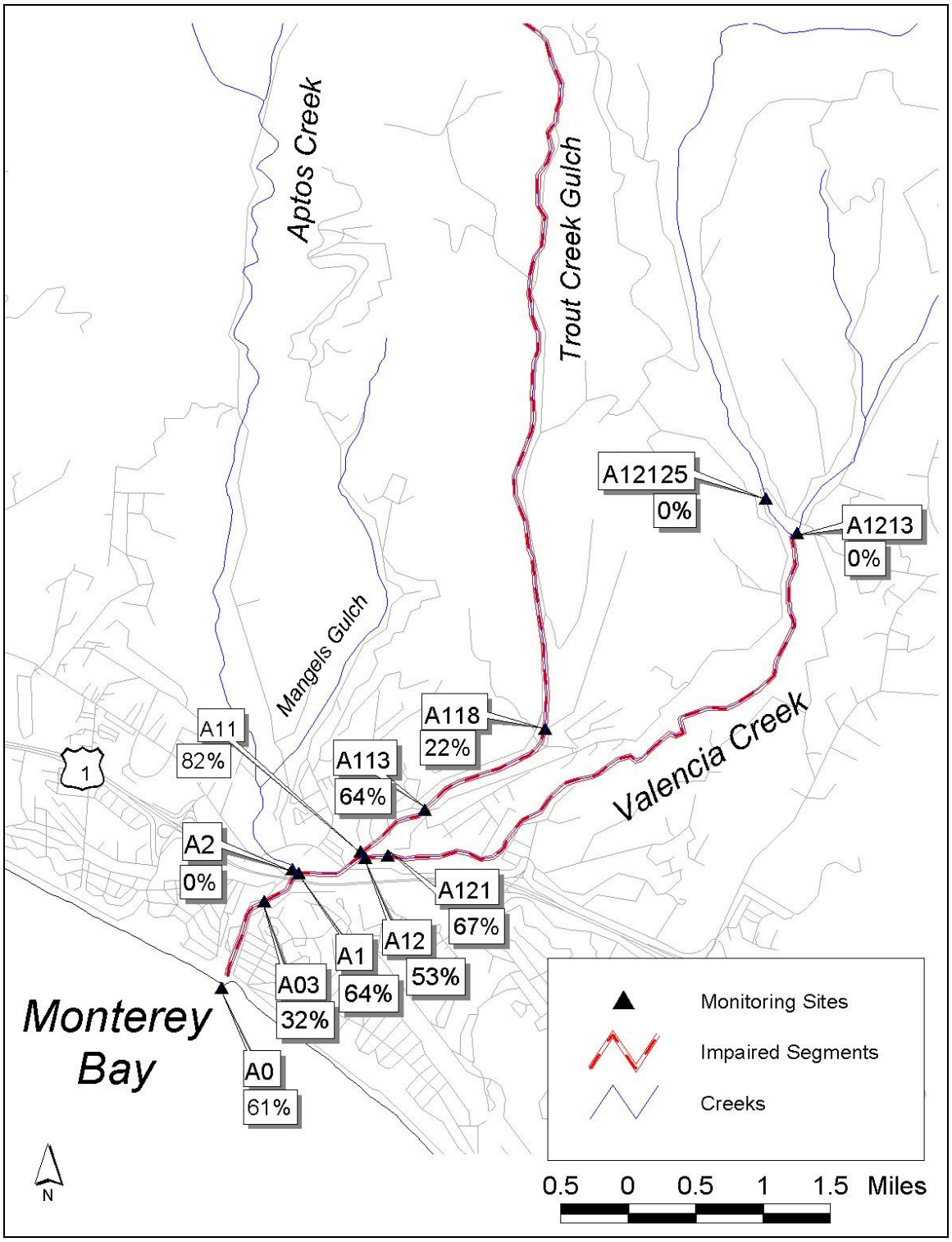

Figure 4. Aptos Watershed Sampling Station Locations and Percent Exceedance of the Single Sample maximum (400 MPN/100 mL) from January 2003 to January 2006.

3.4. Clarifying Spatial Representation of Waterbodies Needing TMDLs

The following section delineates exactly what portions of the Aptos Watershed will need TMDLs. (Figure 4) shows these impaired segments.

Aptos Creek

Aptos Creek demonstrated exceedance of water quality of objectives from the mouth of the creek, to the confluence of Valencia Creek. Upstream of the confluence with Valencia Creek, data did not indicate impairment. As a result, staff developed TMDLs for Aptos Creek only below the confluence with Valencia Creek.

Trout Gulch

Trout Gulch demonstrated impairment from the confluence with Valencia Creek upstream to sampling station A118. Staff did not have additional data upstream of this point. However, pasture land above station A118 can contribute to bacteria impairment. Therefore, staff developed a TMDL for all of Trout Gulch.

Valencia Creek

Valencia Creek demonstrated exceedance of water quality objectives from the confluence with Aptos Creek upstream to site A121. From site A21 is impaired. Site A1213 is not impaired. Somewhere between site A121 and site 1213, Valencia Creek converts from being impaired to not being impaired. Land uses within this reach, such as pasture lands and low intensity residential, can contribute to bacteria impairment.

3.5. Water Quality Investigation Results

Microbial Source Analysis Results

Genetic ribotyping is a microbiological source tracking method that differentiates animal *Escherichia coli (E. coli)* from other sources of animal *E. coli*. The University of Washington Public Health Department has worked with over 100,000 *E. coli* samples and has developed genetic fingerprints that are specific to certain *E. coli* sources of animal origin. This method compares Ribonucleic Acid (RNA) band patterns extracted from contaminated stream sites and known sources of *E. coli*. Numerous entities in California have successfully used this method, including California Polytechnic State University's (San Luis Obispo) study of Morro Bay, California.

Although this report presents various sources in "percent contribution" values, staff considered ribotyping results only as an estimate of possible sources and of relative source contributions among all of the various sources.

County personnel collected water samples and submitted them for source tracking analysis from five different locations in the Aptos Watershed.

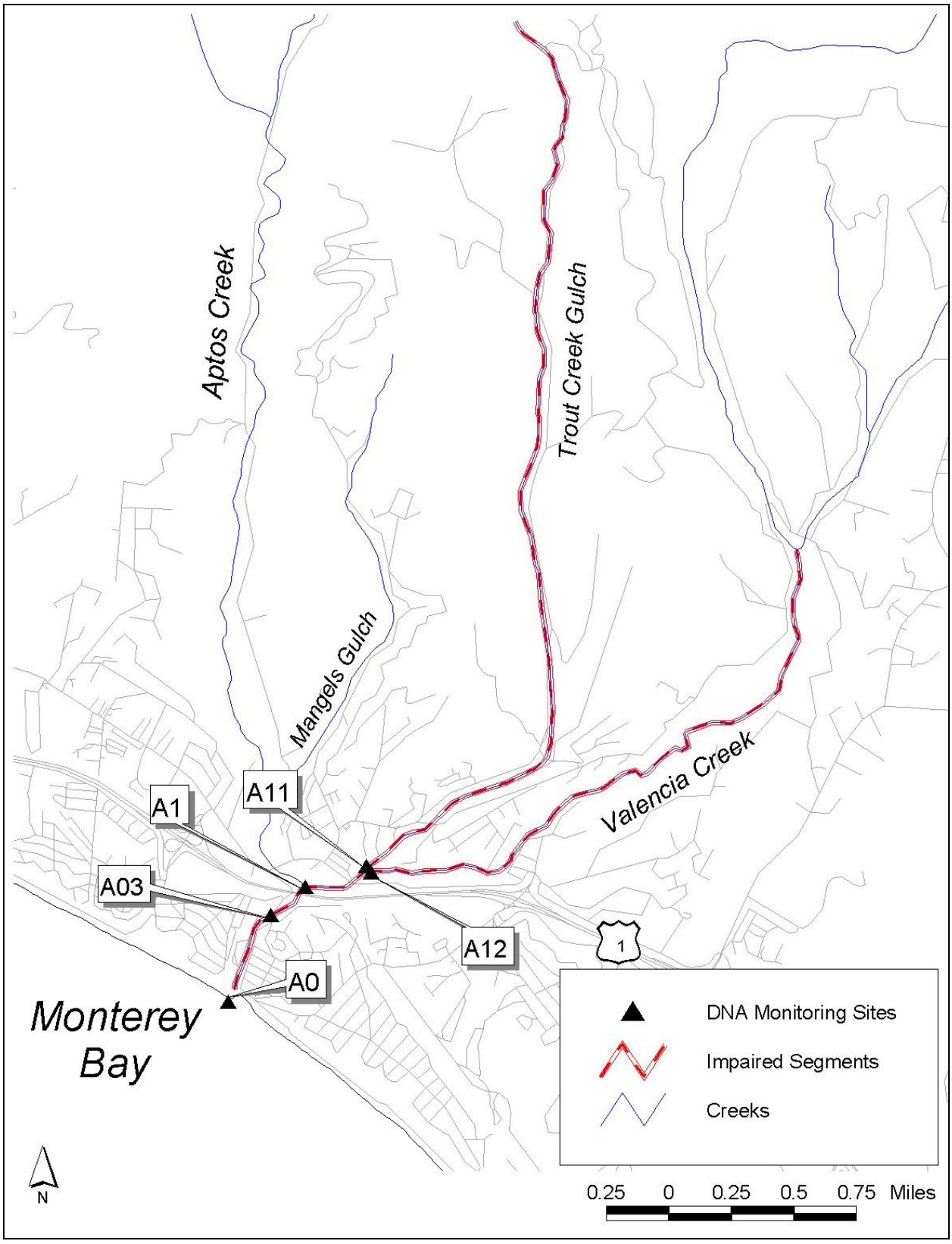

Figure 5. Aptos Watershed Ribotyping Data Stations

County staff collected ribotyping samples between January 13, 2004 and February 3, 2005. The majority of samples were taken during dry weather. Because the majority of samples were taken during dry weather, there were not enough data to determine a meaningful seasonal variation in terms of source contribution. Sometimes one source had a higher percent contribution during the wet sample collection, while another sample showed the same source to be higher during the dry season sampling. The ribotyping analysis results, combined to show both wet and dry sample collections, are shown in Table 6.

Table 6. Percent Source Contributions from Aptos Watershed (1/13/04 – 2/3/05)

Is the source considered controllable or uncontrollable?	Sites →	Aptos Creek @ Mouth (A0)	Aptos Creek @ Bridge on Spreckles (A03)	Trout Gulch @ Valencia Creek (A11)	Valencia Creek @ Aptos (A1)	Valencia Creek @ Trout Gulch (A12)
	Source					
Natural / Uncontrollable	Bird[1]	62%	52%	43%	48%	40%
	Marine Mammal	0%	0%	0%	0%	0%
	Wildlife	11%	19%	17%	7%	17%
Anthropogenic / Controllable	Cat	1%	0%	0%	0%	0%
	Cow	0%	0%	0%	0%	0%
	Dog	7%	11%	17%	22%	14%
	Horse	1%	0%	1%	7%	0%
	Human	2%	0%	0%	0%	0%
May or may not be controllable	Rodent[2]	10%	15%	7%	7%	17%
	Unknown	6%	3%	13%	7%	12%
	Total No. Days Water Sampled	13	9	5	3	2
	Total Water Samples	30	23	21	9	13
	Total Isolate Samples	128	93	69	27	42

1 – Bird is listed under "natural/uncontrollable" because most often, impacts from birds are uncontrollable. In instances where human-made structures provide a roosting location right over the creek or where bird contribution is increased due to dumpsters, staff might consider these isolated cases as controllable.
2 – Rodent is listed under "may or may not be controllable," because in instances where human-made structures or garbage provide habitat for rodent, they would be deemed controllable. In open space areas, they would be considered wildlife and therefore would not be controllable.

Genetic data showed that a majority of the sources came from birds and wildlife (between 55% and 73%). These sources are considered natural and largely uncontrollable. A smaller percentage of the sources came from dogs. A much smaller percentage came from horses and humans. Staff considered these sources controllable. Human contribution was only found at one site, the lowest point on the Watershed and only contributed 2%. This human contribution was only found during dry season sampling. Rodents contributed between 7% and 17% at the five sites. It is difficult to ascertain whether or not the rodent contribution should be considered controllable or not. In the

upper Watershed, these rodents would most likely be considered natural and therefore uncontrollable. However, in the urban areas, staff considered rodent populations, in part, controllable.

4. SOURCE ANALYSIS

Staff based the information contained within this section on investigations performed by staff and also on the County's *Assessment of Sources of Bacterial Contamination at Santa Cruz County Beaches* report prepared in March 2006 (Proposition 13 Report). Staff used water quality data, ribotyping results, discharger data and reports, land use data, field reconnaissance work, and conversations with County staff in order to complete the source analysis. Staff did not determine sources solely on ribotyping results, but staff investigated the potential sources identified by ribotyping.

4.1. Mechanisms of Transport for Various Sources of Bacteria

Staff determined the following sources contribute bacteria. These sources are discussed below. The implementation plan section (section 10) provides actions staff concluded were necessary to attain water quality objectives.

4.1.1 WASTE DISCHARGES SUBJECT TO REGULATION BY THE WATER BOARD

This section discusses sources subject to discharge regulation by the Water Board. This section breaks out the mode by which various sources may reach water bodies within the Aptos Watershed.

Local agencies and landowners have already implemented many corrective actions that result in improved water quality. This report provides some additional measures local agencies and land owners can take to continue the water quality improvement efforts already begun.

4.1.1.a. Sewage Spills and Leaks from Municipal System

Sewage can reach the Aptos Creek Watershed from sewer line overflows or leaks. Sewage spills can occur when roots, grease buildup, or other causes block sewer lines. Leaks can also occur from cracked lines or lines with poor connections. When sewer lines are blocked or leaking, sewage may run onto the street, into gutters, and into storm drains. Sewer leaks can also occur in small volumes or below the ground surface. These types of leaks often continue unnoticed.

Aptos Watershed does not have a Waste Water Treatment Plant contained within its boundaries. However, the Watershed does have a collection system that collects wastewater within the Watershed's boundaries and takes this wastewater to the City of

Santa Cruz's Waste Water Treatment Plant (WWTP). The Santa Cruz County Sanitation District Waste Discharge Requirements (WDR), Order No. R3-2005-43, addresses the County's WWTP collection system.

The Proposition 13 Report (2006) stated that,

> Almost 4700 linear feet of sewer line was video-tested in the Rio del Mar near Aptos Creek. After a review of the logs and videos, Sanitation District staff concluded that, "there are many avenues for high groundwater to enter the sewers and to also flow out of the sewer mains/laterals."

The Sanitation District found sections of sewer mains that need replacing, so there are not any avenues for sewage to exit the mains. Also, because human contribution was not found at any other site except at the mouth of Aptos Creek (2% according to ribotyping analysis), staff assumed that leaks from sewer mains, which are mostly in the lower part of the Watershed, are one conduit for human waste to enter the Aptos Creek Watershed.

Although, staff concluded the sewer system contributes bacteria, staff also observed that the Santa Cruz County Sanitation District is satisfactorily implementing a collection system management plan compliant with their WDRs. The Santa Cruz County Sanitation District has budgeted funds in fiscal year 2005-2006 and proposes to budget funds in FY 2006-2007 to repair leaking sewers.

4.1.1.b. Storm Drain Discharges

Storm drains can be a conduit for bacteria to reach surface water bodies. During storms, rainwater can come in contact with animal waste and carry it to a storm drain.

The Proposition 13 Report (2006) stated that, "limited past sampling suggested high levels of bacteria in the storm drains, but investigations …found the drains to be dry during the summer period." Because of these results, staff concluded that storm water is likely a source during wet seasons when there is flow in the storm drains but staff does not know the source of bacteria contribution to the creek during the dry season. Because staff could not categorically conclude there is no contribution during the dry season, we assumed there may be minor dry weather contribution.

Bacteria in urban runoff are generated by pets, birds, rodents, and/ or wildlife. Water flowing to storm drains can collect bacteria. This water originates from a variety of sources during wet (from rainfall) and dry weather (from over-watering, car washing, or other forms of cleaning).

4.1.1.b.1. Controllable Bird Waste Transport Mechanisms

Microbial source tracking results indicated that birds were the biggest contributor of bacteria to all five of the stations sampled (between 40% and 62%). While bird waste is considered largely uncontrollable, controllable sources of bird waste may be dumpsters, trashcans, and trash litter. Birds may frequent these locations as feeding sites. Bird

waste may be carried to storm drains or surface waters when storms occur. (And as mentioned earlier, bird waste may also be contained in urban runoff.)

4.1.1.b.2. Pet Waste Transport Mechanisms

Microbial source tracking results showed dog waste was present at all five sampling stations (between 7% and 22%). Pet wastes can reach the creeks via storm drain discharges during wet seasons. Also pet wastes can reach storm drains during dry seasons if wash water comes into contact with pet droppings.

4.1.1.b.3. Controllable Rodent Waste Transport Mechanisms

Microbial source tracking results indicated rodents contributed bacteria to all the sampling stations (between 7% and 17%). Controllable rodents waste can reach the Watershed the same way that bird waste does.

4.1.1.b.4. Dumpster Leachate

When it rains, rainwater can enter dumpsters and discharge leachate. This occurs when dumpsters are uncovered and containers leak. Dumpsters are often repositories for pet waste and human waste (diapers). Microbial source tracking indicated pet waste was present at all five sampling stations (between 7% and 22%) and human waste was present at Aptos Creek mouth (2%).

During dry seasons, bird waste may reach surface waters when trash-holding areas are washed down. Wash down waters may reach storm water drains and surface waters. Microbial source tracking results indicated birds contributed bacteria to all the sampling stations (between 40% and 62%). Staff estimates only small portion of bird waste originates from dumpster leachate.

4.1.1.b.5. Private Laterals

The Santa Cruz County Sanitation District stated that, "there are many laterals (presumed in use and abandoned) whose invert is below the flow of the sewer main and are undoubtedly a source of infiltration and contamination of the surrounding soil," (SCCSD, 2005). The Sanitation District also indicates "most laterals show gaps or no mortar at the main nor at any joints visible up the lateral" and many sections of live laterals have roots going into laterals.

Staff concluded that private laterals are a potential pathogen source based upon the above information and the age of many laterals. Many laterals are old (personal communication with Rachel Lather and phone conversation with Russ Bateson, Santa Cruz County Sanitation District) and, therefore, likely leaking. Ribotyping analysis indicated 2% human waste at the mouth of Aptos Creek. A portion of the human waste could originate from private laterals.

The SCCSD recently adopted a Code (Santa Cruz County District Code Sections 7.04.325 and 7.04.375; March 2006) regarding sanitary sewer collection system maintenance of systems serving four or more units. Staff concludes that the ordinance

may only reduce this source by a small amount as the ordinance does not address private laterals. Summarized, the Code requires that owners of such properties:

1) Maintain their sanitary sewer system to prevent overflows including flushing once during an eighteen month period;
2) Immediately stop an overflow if one occurs and have the problem repaired by a licensed plumber within five working days;
3) Report spills to the SCCSD within 24 hours and submit a written report; and
4) Certify that the sanitary sewer system was inspected prior to the sale of the house or building if the house or building was constructed, or the sewer system was inspected, more than 20 years prior to the date of sale.

The district may impose penalties of up to $2,500.00 against a property owner who fails to perform any act required in the ordinance if the spill reaches public or private property other than the property owner's property.

4.1.1.c. Homeless Encampments

At the June 26, 2006 meeting the Water Board staff held with interested persons, staff learned homeless encampments exist in the Aptos Creek Watershed. Staff concluded human waste potentially contributes pathogens to surface waters at these sites. Ribotyping analysis indicated 2% human waste at the mouth of Aptos Creek. A portion of the human waste could originate from private laterals.

4.1.1.d. Septic System Failures

Staff did not consider septic systems to be a contributing source in this Watershed because there was no human contribution at any of the source tracking sites, except for Aptos Creek at the Mouth (A0). Staff concluded that if septic systems were a major contributor, the ribotyping data would have shown some human contribution at any of the four upstream sites.

4.1.1.e. Farm Animals and Livestock

Source tracking showed that horses contributed bacteria to the Aptos Watershed. Staff concluded the source tracking data is a possible indication of horse contributions, because horses have been observed in this watershed by Water Board staff. Ribotyping results indicated horses only contributed about 1% at the mouth of Aptos Creek. At Trout Gulch at Valencia Creek (A11), again, horses only contributed 1%, while at Valencia Creek @ Aptos (A1), the percentage increased to 7%. This was noteworthy because upstream of site A1, Valencia Creek just before the confluence with Trout Gulch, there was no horse input (site A12). Therefore, it is possible that there is only a small section of creek, the lowest part of Trout Gulch and the confluence of Valencia and Trout Gulch up to the confluence with Aptos Creek that is the main contributor of horse input.

Although there isn't a large input from horses, this source is deemed controllable and needs to be addressed.

During a field visit to the residential part of Valencia Creek in April 2006, staff observed

various farm animals on residential properties such as emu, chickens, goats and horses. These animals may contribute bacteria to the creeks. Although many of these animals were not called out in the source tracking data (i.e., there is not a subcategory for emu, chicken and goats), there is the potential for them to contribute bacteria to the creeks.

4.1.2. NATURAL SOURCES- WASTE DISCHARGES NOT SUBJECT TO REGULATION BY THE WATER BOARD

The Water Board has authority to regulate waste discharges. The Water Board does not have authority to regulate natural sources from wildlife.

Ribotyping results indicate birds and other wildlife (e.g. raccoons, deer) were by far the largest *E. coli* sources in the Aptos Creek Watershed. If we look at all five sampling sites, wildlife, an uncontrollable source, made up between 55% and 73% of the contribution. In contrast, so-called controllable sources made up between 11% and 29%. These sources are not subject to waste discharge regulation by the Water Board. Agencies in charge of land use have authority to require practices that reduce contributions from these sources. For example, Cities can require landowners to install devices that prevent bird-landing areas. Such devices could reduce the quantity of bird excrement that reaches surface waters during storms or during washings.

As mentioned earlier, the Water Board *does* have the authority to regulate natural sources, such as birds, if waste enters the surface waters by activities such as washing trashcans or dumpsters.

4.2. Source Analysis Conclusions

Bacterial sources are summarized below. Staff listed bacterial sources by relative order beginning with the largest source first. Staff used water quality data, ribotyping results, discharger data and reports, land use data, field reconnaissance work, and conversations with County staff in order to complete the source analysis.

Staff concluded the largest bacteria source originates from natural sources. Staff concluded this based on several reasons. Forest lands and open space comprises 88% of the Watershed. Ribotyping results indicated bird waste contributes 40-60% and rodent wastes contribute 7-17% of the E.coli. Staff estimated most of the bird and rodent waste is natural or not controllable.

Staff concluded the relative order of controllable bacteria sources. This report discusses them beginning with the largest controllable source first.

1. Staff concluded storm drain discharges are the largest controllable source. Storm drain discharges occur within the urbanized and low intensity residential areas of this Watershed. These areas include lower Aptos Creek, Valencia Creek, and lower Trout

Gulch Creek. The primary controllable source is pet waste. Ribotyping analysis indicated pet waste contributed between 7-22% of the E.coli. (See Table 6.) The largest portion originated from Valencia Creek (22%). Figure 2 shows much of the Valencia Creek subwatershed is comprised of low intensity residential development. (Staff observed many dogs at the Polo Grounds County Park.) The lower and upper Trout Gulch subwatershed (a tributary of Valencia Creek) also has low intensity residential development. Staff expects dogs contribute E.coli to stormwater runoff in these areas.

Human activities such as uncovered trash may also contribute bird and rodent waste in urban areas and low intensity residential development areas. Staff expects the same areas that contribute dog wastes to also contribute controllable bird and rodent waste

In addition to the above, staff expects storm drains to also contain discharges from private laterals. Private laterals are very likely leaking. Ribotyping results indicated humans contributed 2% of the bacteria. Staff expects a portion of this to include flow from old and leaking private laterals.

2. Staff concluded farm animals and livestock are the second largest controllable bacteria source. Ribotyping results indicated horses contributed 7% of the E.coli to Valencia Creek just above Aptos Creek. Staff expects horses exist at low-intensity residential development and pasture lands. Figure 2 shows much of the Valencia Creek subwatershed is comprised of low intensity residential development. The lower and upper Trout Gulch subwatershed (a tributary of Valencia Creek) also has low intensity residential development. Both these areas also have pasture lands. During a field visit to the residential part of Valencia Creek in April 2006, staff observed various farm animals on residential properties such as emu, chickens, goats and horses. Although many of these animals were not called out in the source tracking data (i.e., there is not a subcategory for emu, chicken and goats), there is the potential for them to contribute bacteria to the creeks.

3. Staff concluded that homeless encampments are the third largest source. Ribotyping results indicated Aptos Creek contained a human component (2%) at the creek mouth. Homeless encampments exist along the creek and are difficult to remove.

4. Staff concluded that municipal sewage spills and leaks are the fourth largest source. Ribotyping results indicated Aptos Creek contained a human component (2%) at the creek mouth. Staff concluded that because the Santa Cruz County Sanitation District has dedicated and plans to dedicate funds to repair this source, that this is the least of the controllable sources. Staff is not proposing any additional implementation activities for this source, because staff concluded the County is fulfilling their WDR through appropriate existing and future plans.

5. CRITICAL CONDITIONS AND SEASONAL VARIATION

This section discusses factors affecting impairment, critical conditions, and seasonal fecal coliform variations.

5.1. Critical Conditions

Many factors influence impairment of portions of the Aptos Creek Watershed. These factors include the following: (1) discharge of bacteria to the Watershed, (2) stream flow transmission, and (3) survival and possible instream fecal coliform population growth.

There are several uncertainties with bacteria. Stream flows may serve to either increase or dilute fecal coliform concentrations. Stagnant pools may be areas where fecal coliform increases due to evaporation or re-growth.

5.2. Seasonal Variations

Staff analyzed fecal coliform data in the Aptos Watershed and found slightly higher levels of fecal coliform during the summer months at most of the stations, but, there is not enough data to conclude this with certainty or statistical significance.

Genetic testing did not include enough wet season samples to make a conclusion whether certain sources are contributing more during either season.

Staff concluded there are no statistically significant seasonal variations based on the data available. Therefore, staff did not adjust load allocations and numeric targets to account for critical conditions or seasonal variations.

6. NUMERIC TARGET

6.1. Numeric Targets

The Basin Plan contains fecal coliform water quality objectives. The fecal coliform numeric targets for Aptos and Valencia Creeks are based on current Basin Plan water contact recreation objectives and the Unites States Environmental Protection Agency (USEPA) water quality criteria.

Table 7. Numeric Fecal Coliform and *E.Coli* Targets for Aptos and Valencia Creeks

Fecal Coliform[a]		***E.coli*[b]**	
Geometric Mean[c]	**Maximum[d]**	**Geometric Mean[c]**	**Maximum[d]**
200 MPN/100 mL	400 MPN/100 mL	126 MPN/100 mL[e]	235 MPN/100 mL[f]

[a] Existing Water Quality Objective for Water Contact Recreation Beneficial Use

[b.] USEPA Ambient Water Quality Criteria for Bacteria-1986

c Geometric mean of not less than five samples over a period of 30 days

d. Not more than 10% of total samples during a period of 30 days exceed

e. Calculated to nearest whole number using equation: geometric mean = antilog10 [(risk level + 11.74) / 9.40].

f: Calculated using the following: single sample maximum = geometric mean * 10^(confidence level factor * log standard deviation), where the confidence level factor is: 75%: 0.68; 82%: 0.94; 90%: 1.28; 95%: 1.65. The log standard deviation from EPA's epidemiological studies is 0.4 for fresh waters.

Should all control measures be in place and fecal coliform levels remain high, investigations (e.g., genetic studies to isolate sources or other appropriate monitoring) will take place to determine if the high level of fecal coliform is due to uncontrollable sources. Responsible parties will demonstrate that controllable sources of fecal coliform are not contributing to exceedance of water quality objectives in receiving waters. If this is the case, staff will consider re-evaluating the targets and allocations. For example, staff may propose a site-specific objective to be approved by the Water Board. The site-specific objective would be based on evidence that natural, or "background" sources alone were the cause of exceedances of the Basin Plan water quality objective for fecal coliform.

7. LINKAGE ANALYSIS

The goal of the linkage analysis is to establish a link between pollutant loads and water quality. This, in turn, supports that the loading capacity specified in the TMDL will result in attaining the numeric target. For this TMDL, this link is established because the numeric targets concentrations are the same as the TMDL, expressed as a concentration. Sources of bacteria have been identified that cause the elevated concentrations of bacteria in the receiving water body. Therefore, reductions in bacteria loading from these sources should cause a reduction in the bacteria concentrations measured. The numeric targets are protective of the recreational beneficial uses; hence the TMDL defines appropriate water quality concentrations.

8. TMDL CALCULATION AND ALLOCATIONS

A TMDL is the pollutant loading capacity that a water body can accept while protecting beneficial uses. Usually, TMDLs are expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), but in the case of bacteria, it is more logical for the TMDL to be expressed as a concentration. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure [40 CFR §130.2(I)]. A concentration TMDL makes more sense in this situation because the public health risks associated with recreating in contaminated waters scales with organism concentration, and bacteria are not readily controlled on a mass basis. Therefore, we are establishing a TMDL as a concentration for bacteria in Aptos Creek, Trout Gulch and Valencia Creek.

Staff proposes the TMDL as the same set of concentrations as staff proposed in the numeric targets section (Table 8).

Table 8. TMDL for Aptos Creek, Trout Gulch and Valencia Creek

Fecal Coliform[a]		***E.coli*[b]**	
Geometric Mean[c]	**Maximum[d]**	**Geometric Mean[c]**	**Maximum[d]**
200 MPN/100 mL	400 MPN/100 mL	126 MPN/100 mL[e]	235 MPN/100 mL[f]

[a] Existing Water Quality Objective for Water Contact Recreation Beneficial Use
[b.] USEPA Ambient Water Quality Criteria for Bacteria-1986
c Geometric mean of not less than five samples over a period of 30 days
d. Not more than 10% of total samples during a period of 30 days exceed
e. Calculated to nearest whole number using equation: geometric mean = antilog10 [(risk level + 11.74) / 9.40].
f: Calculated using the following: single sample maximum = geometric mean * 10^(confidence level factor * log standard deviation), where the confidence level factor is: 75%: 0.68; 82%: 0.94; 90%: 1.28; 95%: 1.65. The log standard deviation from EPA's epidemiological studies is 0.4 for fresh waters.

8.1. Wasteload and Load Allocations

The load allocations for all non-natural (controllable) sources and corresponding responsible party are equal to the TMDL concentration. The allocation is the same for each responsible party. The responsible party shall not discharge or release a "load" of bacteria that will increase the bacteria concentration above the assimilative capacity or TMDL concentration of the water body. All surface waters will be held to these load allocations. The parties responsible for the allocation to non-natural (controllable) sources are not responsible for the allocation to natural (uncontrollable) sources.

Table 9. Allocations and Responsible Parties

WASTE LOAD ALLOCATIONS		**Receiving Water Fecal Coliform (MPN/100mL)**	**Receiving Water *E. coli* (MPN/100mL)**
Water body	**Responsible Party and Source**		
Aptos Creek, Trout Gulch, Valencia Creek	Santa Cruz County (Storm Water Discharge)	≤ 200[1] and 400[2]	≤ 126[1] and 235[2]
LOAD ALLOCATIONS		**Receiving Water Fecal Coliform (MPN/100mL)[1]**	**Receiving Water *E. coli* (MPN/100mL)**
Water body	**Responsible Party and Source**		
Aptos Creek, Trout Gulch, Valencia Creek	Santa Cruz County Sanitation District (Sewage Spills and Leaks)	≤ 200[1] and 400[2]	≤ 126[1] and 235[2]
Aptos Creek, Trout Gulch, Valencia Creek	Land Owners with Homeless Encampments (Homeless Persons)	≤ 200[1] and 400[2]	≤ 126[1] and 235[2]
Aptos Creek, Trout Gulch, Valencia Creek	Operators or owners of livestock facilities and animals (Livestock or other animals)	≤ 200[1] and 400[2]	≤ 126[1] and 235[2]
Aptos Creek, Trout Gulch, Valencia Creek	Natural Sources	≤ 200[1] and 400[2]	≤ 126[1] and 235[2]

[1] As log mean of five (5) samples taken in a 30-day period occurring within each season
[2] As a maximum with not more than 10% exceedance during 30-day period

When a responsible party implements the control measures (including monitoring and submittal of documentation) required herein, staff will assume that they have attained their respective allocation. Should all control measures be in place, fecal coliform levels remain high, and the TMDL not be met, investigations (e.g., genetic studies to isolate sources or other appropriate monitoring) may take place to determine if the high level of fecal coliform is due to uncontrollable sources. Responsible parties will demonstrate that controllable sources of fecal coliform are not contributing to exceedance of water quality objectives in receiving waters. If this is the case, staff will consider re-evaluating the targets and allocations. For example, staff may propose a site-specific objective to be approved by the Water Board. The site-specific objective would be based on evidence that natural, or "background" sources alone were the cause of exceedances of the Basin Plan water quality objective for fecal coliform.

8.2. Margin of Safety

The TMDL requires a margin of safety component that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water (CWA 303(d)(1)(C)). For bacteria in Aptos Creek, Trout Gulch, and Valencia Creek, a margin of safety has been established implicitly through the use of protective numeric targets, which are the water quality objectives for the water contact recreation beneficial use.

The pathogen TMDL for Aptos Creek, Trout Gulch, and Valencia Creek is the water quality objective for water contact recreation. The Central Coast Region Water Quality Control Plan states that, "controllable water quality shall conform to the water quality objectives..." When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality" (Basin Plan, p. III-2). Because the allocation for controllable sources is set at the water quality objective, if achieved, these allocations will by definition contribute as much as possible to achieving the water quality objectives in the receiving water. Thus, in this TMDL there is no uncertainty that controlling the load from controlled sources will positively affect water quality by reducing the bacterial contribution.

However, in certain locations there is a high probability that non-controllable, or, natural sources will occur at levels exceeding water quality objectives. And while it is controllable water quality conditions ("actions or circumstances resulting from man's activities" (Basin Plan, p. III-2)) that must conform to water quality objectives, receiving water quality will contain discharge from both controllable and natural sources.

The ability to differentiate the controllable from the natural sources is the chief uncertainty in this TMDL. The ribotyping method used in this report is one of the best methods available, but it is not 100 percent accurate. This ribotyping method results in greater variability of false positive rates among genotypic library-based methods, with incorrect classification ranging from 25-75% (John F. Griffith, Stephen B. Weisberg, Charles D. McGee 2003).

Additionally, these data, which confirmed the presence of natural sources, do not estimate loads; they only provide the relative percent of samples that indicated the type of source. Reporting and monitoring will indicate whether the allocations from controllable sources are met, thereby minimizing any uncertainty about the impacts of loads on the water quality.

9. PUBLIC PARTICIPATION

Public participation began when the County developed a report required by Proposition 13 Grant Funds. The grant required a Technical Advisory Committee to meet periodically.

Water Board staff presented TMDL project report results at two meetings. Water Board staff solicited comments at both these meetings. One meeting was held during the early phase of Water Board project plan development on November 16, 2005. At the second meeting, on June 26, 2006, Water Board staff presented preliminary project report findings. Water Board staff incorporated public comments into this document where appropriate. Staff also scoped issues pursuant to the California Environmental Quality Act at this meeting. Staff will prepare environmental documents indicating any potential environmental impacts and considering alternative allocations schemes or implementation strategies prior to soliciting formal public comments on this TMDL and implementation plan.

Water Board staff will solicit public comments before the Water Board public hearing to consider adoption of an Aptos Creek TMDL. The Water Board will also accept public comments at the Water Board public hearing.

10. IMPLEMENTATION PLAN

The purpose of the Implementation Plan is to describe the steps necessary to reduce bacterial loads and to achieve the TMDL. While staff concludes the majority of the impairment is due to natural sources, it is necessary that all of the controllable sources be addressed to comply with the Basin Plan and achieve the TMDL. The Implementation Plan identifies the following: 1) actions expected to reduce bacterial loading; 2) parties responsible for taking these actions; 3) regulatory mechanisms by which the Water Board will assure these actions are taken; 4) reporting and evaluation requirements that will indicate progress toward completing the actions; 5) and a timeline for completion of implementation actions. A monitoring plan designed to measure progress toward water quality goals is included in the following section.

All actions proposed are requirements that exist or are proposed to be taken pursuant to an existing regulatory mechanism (e.g. permit or prohibition). As such, no new regulations are required and the Water Board's Executive Officer is authorized to take the proposed steps to insure implementation of appropriate actions to reduce bacterial loading.

Staff differentiated existing versus proposed requirements below.

10.1. Implementation Actions

Staff discusses the proposed actions necessary for the water bodies to attain bacteria water quality standards in this section. The actions are presented by the sources of bacteria to Aptos Creek, Trout Gulch, and Valencia Creek.

Table 10 in Section 10.2 provides a summary or required implementation tasks.

The following discussion provides detailed information regarding requirements to attain the TMDL.

Sewage Spills and Leaks for Municipal Systems

Existing Control Mechanism

The Water Board has issued Waste Discharge Requirements (WDR) to Santa Cruz County Sanitation District. The County of Santa Cruz WDR requires the County to implement a Collection System Management Plan (CSMP). CSMP components include the following: (1) complete testing and proactive upgrade of sewer lines; (2) proactive sewer line maintenance, and (3) spill prevention and cleanup improvements.

Staff concluded that the Santa Cruz County Sanitation District is satisfactorily implementing the CSMP. No additional requirements are necessary. For example, the County is planning on replacing sections of the sewer main in areas that they have found to be problematic. The Proposition 13 Report states that,

> …over 2350 linear feet of line is recommended to be replaced. Funding for the design is included in the 2005-06 budget and the replacement is anticipated to be constructed in 2006-07. Replacement of all the lines and reconnection of the existing laterals is estimated to cost $1,015,000.

Storm Drain Discharges

Existing Control Mechanisms

The State Water Resources Control Board adopted a General Permit for storm water discharge. The General Permit requires smaller State municipal dischargers, such as the County of Santa Cruz, to develop and implement a Storm Water Management Plan (SWMP). The SWMP goal is to reduce pollutant discharge to the maximum extent practicable. The management programs must specify what best management practices the municipality will use to address certain program areas. The program areas include public education and outreach, illicit discharge detection and elimination, construction and post-construction, and good housekeeping for municipal operations. The County will be required to report annually on the status of implementation of measures to control bacteria in stormwater.

At the time of writing this report, the Water Board had not approved a SWMP for the County of Santa Cruz.

Water Board staff proposes all controllable storm water discharges be controlled to the maximum extent practicable.

The General Permit requires the permittee to submit annual reports. The annual report must specify measurable goals for the following year. The annual report will also contain monitoring information. The permittee will include information such as visual monitoring or tracking information to determine if measurable goals were attained during the previous year. The annual report will also evaluate actions the permittee implemented during the previous year and propose changes for the following year.

Water Board staff will review annual reports and assess if management practices were implemented and measurable goals were attained. If Water Board staff determines the permittee's actions were unsatisfactory, the Water Board will initiate and complete standard enforcement protocol to require permit compliance.

Storm Water Management Plan Requirements for the County of Santa Cruz

Staff proposes the County of Santa Cruz identify the specific sources that contribute pathogens to surface waters. The County should identify and implement public participation and outreach management measures. The County must develop and implement enforceable means of reducing fecal coliform loading to storm water. The Storm Water Management Plan must include the mechanisms for reaching specific target source groups.

Some preventative management measures individuals can use include:

1. Eliminate over watering and runoff of irrigation water into the street;
2. Take cars to a carwash or wash them at locations that won't run into the street;
3. Discharge wash water from carpet cleaning, mop buckets, floor mat washing, etc. should be discharged to the sanitary sewer;
4. Clean up spills with mops or absorbent material rather that washing into a gutter or storm drain inlet; and
5. Install anti-microbial filter fabrics in stormdrains

The County should continue to maintain a street sweeping program to help prevent bacteria from reaching storm drains. Staff proposes the County continue to regularly clean storm drains to remove silt and organic material accumulations, particularly before the first storm of the season. Low impact development principles should be applied to new and redevelopment to minimize and prevent addition of new sources.

Storm Water Management Plan Requirements for the County of Santa Cruz: Pet Wastes
Staff proposes the County include management practices and annual reporting of such practices that specifically reduce pet waste loading. The County of Santa Cruz has an ordinance enforcing pet waste pick-up and the City of Capitola has an ordinance enforcing dog waste pick-up. While these are commonly enforced in public places, pet

waste on a pet owner's property or residence may also be at risk of entering waterways if not disposed of properly. Therefore, the County should undertake additional measures to educate residents and homeowners regarding the vulnerability of these areas to pollution from dog, and other pet waste.

Storm Water Management Plan Requirements for the County of Santa Cruz: Dumpster Leachate and Controllable Rodent, Bird, and Wildlife Waste

Staff proposes the County include management practices that specifically address dumpsters/receptacles serving restaurants or other facilities within the agencies' jurisdiction to eliminate discharge leachate. Additionally, the County must consider ways to eliminate other controllable sources from rodents, birds, or other wildlife. Fore example, the County should require that dumpsters always be covered and be replaced when leaks occur. The County should report on status of addressing this source and implementing practices in their annual report once they have an approved Storm Water Management Plan.

Storm Water Management Plan Requirements for the County of Santa Cruz: Private Laterals

The County must evaluate the contributions of bacteria from private laterals and develop appropriate measures to reduce bacteria loading from private laterals.

Storm Water Management Plan Requirements for the County of Santa Cruz: Proposed Public Education

Santa Cruz County must identify how they will educate the public, what best management practices the County will use to educate the public, and goals for the public education and outreach program. The County should specifically target education to landowners regarding management measures to minimize leaks from private laterals and homeless encampment discharges.

Storm Water Management Plan Requirements for the County of Santa Cruz: New Development and Redevelopment

The County must develop and implement low impact development principles and practices for new development and redevelopment to minimize and prevent addition of new bacteria sources.

Homeless Encampments and Farm Animals/Livestock

Homeless encampments must comply with the existing discharge prohibition for the Aptos Creek watershed.

Law enforcement officers are utilized to remove homeless encampments. However, removal can take up to a year. After homeless encampments are removed, homeless encampments often relocate to other sites. Therefore, the discharge of waste from homeless encampments continues. Existing law enforcement efforts are not resulting in decreases of waste from homeless encampments.

Staff proposes to require land owners whose land supports homeless encampments to develop and implement strategies to reduce/eliminate bacteria loading from these encampments. Staff also proposes land owners submit documentation to Water Board staff showing no discharge is occurring from encampments. Staff will work with landowners and agency staff to develop the details of documentation during the Staff implementation tracking phase that occurs after the TMDL is adopted.

As shown earlier in this report, horses contribute a small portion of bacteria to the Watershed. Other potential farm animal sources include emu, goat, chicken, and other livestock. Santa Cruz County Environmental Health Department has had success with runoff and manure management at many of the larger operations.

The *Nonpoint Source Implementation and Enforcement Policy*, adopted as state law in August 2004, requires the Regional Water Boards to regulate all nonpoint sources (NPS) of pollution using the administrative permitting authorities provided by the Porter-Cologne Act. Nonpoint source dischargers must comply with Waste Discharge Requirements (WDRs), waivers of WDRs, or Basin Plan Prohibitions by participating in the development and implementation of Nonpoint Source Pollution Control Implementation Programs. NPS dischargers can comply either individually or collectively as participants in third-party coalitions. (The "third-party" Programs are restricted to entities that are not actual discharges under Regional Water Board permitting and enforcement jurisdiction. These may include Non-Governmental Organizations, citizen groups, industry groups, Watershed coalitions, government agencies, or any mix of the above.) All Programs must meet the requirements of the following five key elements described in the NPS Implementation and Enforcement Policy. Each Program must be endorsed or approved by the Regional Water Board or the Executive Officer (where the Regional Water Board has delegated authority to the Executive Officer).

Key Element 1: A Nonpoint Source Pollution Control Implementation Program's ultimate purpose must be explicitly stated and at a minimum address NPS pollution control in a manner that achieves and maintains water quality objectives.

Key Element 2: The Program shall include a description of the management practices (MPs) and other program elements dischargers expect to implement, along with an evaluation program that ensures proper implementation and verification.

Key Element 3: The Program shall include a time schedule and quantifiable milestones, should the Regional Water Board require these.

Key Element 4: The Program shall include sufficient feedback mechanisms so that the Regional Water Board, dischargers, and the public can determine if the implementation program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required (See Section 10, Monitoring Program).

Key Element 5: Each Regional Water Board shall make clear, in advance, the potential consequences for failure to achieve a Program's objectives, emphasizing that it is the responsibility of individual dischargers to take all necessary implementation actions to meet water quality requirements.

Requirements for Land Owners with Homeless Encampments and Oners/Operators of Farm Animals/Livestock:

Landowners with homeless encampments and operators and/or owners of farm animals/livestock must comply with the existing discharge prohibition for the Aptos Creek Watershed.

Staff recommends landowners with homeless encampments and operators and/or owners of livestock facilities and animals develop and implement strategies to reduce and/or eliminate fecal coliform loading. The Executive Officer will require such owners or operators to prepare and submit plans that assess their contribution to bacterial loading and describe steps they are or will take to insure any bacterial loading is minimized or eliminated. The plans should address the elements of the Nonpoint Source Pollution Control Implementation Program.

Ecology Action has obtained Proposition 13 Grant Funds to improve water quality discharges resulting from livestock operations. The Grant includes the following tasks: (1) workshops to present pollution prevention approaches, (2) a pollution reduction demonstration, (3) peer recognition at an awards ceremony for facilities that have implemented or maintained exemplary management practices, and (4) a Feasibility and Market Study or a pilot manure hauling/composting service. This project is a joint effort of the Ecology Action, Santa Cruz County Resource Conservation District, and the Santa Cruz Horsemen's Association.

The NPS policy requires regulation of these farm animal/livestock sources. The work performed by Ecology Action may evolve into a "third-party" program. As discussed above, dischargers may either individually or collectively, as participants in third-party coalitions, insure waste discharge programs are consistent with the NPS program elements.

County of Santa Cruz zoning regulations state that the use of stables, paddocks, or corrals must be accompanied by an erosion control plan prepared pursuant to Section 16.22.060 of County Planning and Zoning Regulations. Because rainfall runoff transports sediment and manure similarly, compliance with these County regulations could result in at least partial completion of this TMDL Implementation Action. However, additional measures

are required for facilities that allow non-sterile manure to come into contact with rainwater and enter surface waters through runoff. Through preparation of a Nonpoint Source Pollution Control Implementation Program operators or owners of such facilities could identify non-sterile manure management measures. Possible management measures include:

- Runoff management, including diversion of clean water from contact with holding pens, animals, and manure storage facilities through the use of berms, diversions, roofs, or enclosures;
- Grass waterways;
- Critical plantings;
- Filter strips;
- Composting manure; and
- Daily clean up.

10.2. Summary of Required Actions

Table 10 outlines the schedule of required implementation actions. The actions in the table below represent minimum actions and schedules required. The Water Board may, at its discretion, alter the tasks defined below if sufficient water quality improvements are not realized. The Water Board will make modifications to the tasks listed below pursuant to, but not limited to, the regulatory mechanisms articulated in the table. Also note that tasks requiring monitoring activities refer to monitoring efforts that are described in the Monitoring Plan, which is outlined in the next section of this document.

Table 10. Schedule and Trackable Implementation Actions of Responsible Dischargers

Implementing Party	Sources	Regulatory Mechanism(s)	Actions of Implementing Party	Schedule of Action(s)
Santa Cruz County	Storm Drain Discharges	Anticipated Small MS4 Permit	1. SWMP: The County will implement actions (including addressing urban runoff; pet wastes; dumpster leachate; controllable rodent, bird, and wildlife waste; public education; and new development/redevelopment) to reduce bacteria loading from urban sources. 2. Annual Report: The County will report specific measures that have and/or will be taken to reduce bacteria loading from urban sources. The Report will provide demonstration that fecal coliform concentrations from the storm drain were reduced to the maximum extent practicable. 3. Monitoring: The County of Santa Cruz will implement the monitoring requirements in Section 11.	1. The County will submit an Annual Report within one year after SWMP adoption by the Water Board. 2. The Water Board staff will review the Annual Report and require changes to insure reduction in bacteria loading, if necessary.

Implementing Party	Sources	Regulatory Mechanism(s)	Actions of Implementing Party	Schedule of Action(s)
Land owners with farm animals and livestock	Farm Animals/Livestock	1. Basin Plan Discharge Prohibition OR 2. Waste Discharge Requirements or Waiver of Waste Discharge Requirements	1. Submit documentation demonstrating elimination of discharges that complies with Basin Plan Prohibition OR submit Nonpoint Source Implementation Program that can serve as basis of WDRs or Waiver of WDRs: Landowners will 1) develop, implement, and document strategies to eliminate fecal coliform loading from farm animal and livestock facilities (e.g., pens, corrals, barns) into surface waters of the Aptos Creek Watershed; or 2) landowners will document to the Executive Officer of the Water Board that land activities do not cause waste to pass into waters of the state. 2. Triennial Report: All land owners shall submit a Triennial Report documenting that measures are in place and effectively minimizing discharges or demonstrating that no discharge is occurring from animal facilities. 3. Monitoring: Land owners with farm animals and livestock will implement monitoring requirements that will be determined during the TMDL implementation phase.	1. Within six months of receiving a Water Board request, landowners will provide documentation demonstrating waste discharges are not occurring OR submit Nonpoint Source Implementation Programs. 2. The Water Board staff will review the Triennial Report and require changes to insure reduction in bacteria loading, if necessary.

Implementing Party	Sources	Regulatory Mechanism(s)	Actions of Implementing Party	Schedule of Action(s)
Land owners with homeless encampments	Homeless Encampment Waste	1. Basin Plan Discharge Prohibition OR 2. Waste Discharge Requirements or Waiver of Waste Discharge Requirements	1. Submit documentation demonstrating elimination of discharges that complies with Basin Plan Prohibition OR submit Nonpoint Source Implementation program that can serve as basis of WDRs or Waiver of WDRs: Landowners will 1) develop, implement, and document strategies to eliminate fecal coliform loading into surface waters of the Aptos Creek Watershed; or 2) landowners will document to the Executive Officer of the Water Board that land activities do not cause waste to pass into waters of the state. 2. Triennial Report: All land owners shall submit a Triennial Report demonstrating that no discharge is occurring from homeless encampments. 3. Monitoring: Land owners with homeless encampments will implement monitoring requirements that will be determined during the TMDL implementation phase.	1. Within six months of receiving a Water Board request, landowners will provide documentation demonstrating waste discharges are not occurring OR submit Nonpoint Source Implementation Programs. 2. The Water Board staff will review the Triennial Report and require changes to insure reduction in bacteria loading, if necessary.

10.3. Evaluation of Implementation Progress

Water Board staff will conduct a review of implementation actions according to the schedule identified in Table 10. Water Board staff will use annual reports, NPS Pollution Control Implementation Programs, as well as other available information, to review water quality data and implementation efforts as well as overall progress towards achieving the allocations and the numeric targets.

Water Board staff may conclude that ongoing implementation efforts are insufficient to ultimately achieve the allocations and numeric targets. If staff makes this determination, staff will recommend that additional reporting, monitoring, or implementation efforts be required either through approval by the Executive Officer (e.g. pursuant to Section 13267 or Section 13383 of the California Water Code) or by the Water Board (e.g. through revisions of existing permits and/or a Basin Plan Amendment). Staff may conclude that at the time of review, he/she expects implementation efforts to result in achieving the

allocations and numeric targets. In that case, existing and anticipated implementation efforts should continue. Water Board staff reviews will continue until the TMDL is achieved.

Responsible implementing parties identified in Table 10 will be required to monitor according to the proposed monitoring plan (see Section 11) for at least three years, at which time Water Board staff will determine the need for continuing or otherwise modifying the monitoring requirements. If it is demonstrated that controllable sources of bacteria are not contributing to exceedance of water quality objectives in receiving waters, staff will consider modifying numeric targets and/or allocations. This may result, for example, in staff establishing a site-specific objective for the Watershed. The site-specific objective would be based on evidence that natural, or "background" sources alone were the cause of exceedances of the Basin Plan water quality objective for fecal coliform.

10.4. Timeline and Milestones

Staff anticipates that the allocations, and therefore the TMDL, will be achieved ten years from the date of TMDL approval. The estimation is based on the cost and difficulty inherent in identifying fecal coliform/*E. coli* sources (i.e. human source vs. livestock source) from all sources. The estimation is also based on the uncertainty of the time required for water quality improvements resulting from best management practices to be realized. The Municipal Separate Storm Sewer System Storm Water Management Plan permits outline a 5-year schedule for full implementation of best management practices (BMPs) and activities. In general, storm water BMPs are designed to achieve compliance with water quality standards to the maximum extent practicable through an iterative process.

Staff anticipates that the full in-stream positive effect of all the management measures will be realized gradually. Staff therefore set a goal for TMDL attainment of ten years after TMDL adoption. In addition, storm water permits or nonpoint source implementation programs may include additional provisions that the Water Board determines are necessary to control pollutants (CWA section 402(p)(3)(B)(iii)). The Water Board will consider additional requirements if implementation of management practices do not result in achievement of water quality objectives.

11. MONITORING PLAN

11.1. Introduction

The Monitoring Plan outlines the monitoring sites, frequency of monitoring, and parties responsible for monitoring. The monitoring proposed below for TMDL compliance and evaluation was the minimum staff found was necessary. However, if a change in these requirements is warranted after the TMDL is approved, the Executive Officer and/or the Water Board will require such changes.

11.2. Monitoring Sites, Frequency, and Responsible Parties

Table 11 identifies the Agency monitoring required for this TMDL. Staff proposes Agencies monitor fecal coliform and *E. coli* monitoring in receiving waters at the following stations:

- A0 - Aptos Creek @ Mouth
- A03 - Aptos Creek @ Bridge On Spreckles
- A1 - Valencia Creek @ Aptos Creek
- A12 - Valencia Creek @ Trout Gulch
- A121 - Valencia Creek Behind School
- A113 - Trout Gulch @ Valencia Road
- A11 - Trout Gulch @ Valencia Creek

In addition to the receiving water locations, staff also proposes Agencies monitor fecal coliform and E.coli monitoring in stormwater. Staff proposes sampling at three sites. Staff selected these sites because the will measure possible bacteria sources from urban and low intensity residential areas. These sites are approximately equidistant from one another. Therefore, these sites propose a good spatially distributed representation of stormwater.

Table 11 will become effective six months following adoption of the TMDL by the Water Board. The responsible party must provide the data to the Water Board in subsequent annual reports required by the Small MS$ Permit or submit them in a separate technical report.

Table 11. Monitoring Required

Monitoring Site	Responsible Party	Number of Samples per year	Constituent[2] (#/100 mL)
A0 - Aptos Creek @ Mouth	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season • Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*
A03 - Aptos Creek @ Bridge On Spreckles	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season • Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*
A1 - Valencia Creek @ Aptos Creek	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season • Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*
A12 - Valencia Creek @ Trout Gulch	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season • Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*

Monitoring Site	**Responsible Party**	**Number of Samples per year**	**Constituent[2] (#/100 mL)**
A121 - Valencia Creek Behind School	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season • Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*
A113 - Trout Gulch @ Valencia Road	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season • Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*
A11 - Trout Gulch @ Valencia Creek	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season • Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*
STORM WATER MONITORING			
Esplanade @ Aptos Creek	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*

Monitoring Site	Responsible Party	Number of Samples per year	Constituent[2] (#/100 mL)
Spreckles Bridge at Mooshead Drive	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*
Soquel Drive by Railraod Track and Valencia Creek	Santa Cruz County Environmental Health[1]	**20** • One sample per month • Five samples in a 30-day period taken once during the dry season Five samples in a 30-day period taken once during the wet season	Fecal coliform and *E. coli*

1- Results shall be submitted annually to the Water Board.
2- After two years of collecting both fecal coliform and *E. coli*, the Water Board will only require analysis for *E. coli*.

Landowner monitoring for bacteria will provide information for this TMDL. Landowners have the option of performing individual monitoring or participating in a cooperative monitoring program. Individual landowner monitoring can comprise either water quality monitoring or other forms of monitoring (such as a report documenting visual site inspections supported by site photos). Water Board staff will review data every three years to determine compliance with the TMDL. If the executive officer determines additional monitoring is needed, he shall request it pursuant to Section 13267 of the California Water Code.

11.3. Reporting

Table 10 identifies Agency's necessary reporting activities.

The Water Board will issue a Water Code Section 13267 letter to the parties responsible for receiving water monitoring and implementation reporting described in Table 10. Section 13267 states the Water Board may investigate water quality and the Water Board may require suspected dischargers to furnish monitoring program reports.

The parties responsible for implementation and monitoring will incorporate the results of monitoring efforts in reports filed pursuant to the WDR, Small MS4 Stormwater Permit, Nonpoint Source Implementation Program, or other correspondence as requested by the Water Board pursuant to California Water Code Section 13267.

If reporting changes become necessary based on staff's assessment of the TMDL implementation progress, the Executive Officer of the Water Board will require such changes. At a minimum, the Water Board will evaluate monitoring reporting data and implementation reporting information every three years.

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Appendix 1. Water Quality Data

Appendix 2. Microbial Source Tracking Data